REMARKS

Claims 1-4 are pending in this application. Claims 5-16 have been added.

The Office Action dated June 2, 2004, has been received and carefully reviewed. As a result of that Office Action, claims 1 and 3 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kayahara (U.S. Patent No. 6,029,614, hereinafter "Kayahara") in view of Lang and claims 2 and 4 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kayahara in view of Lang and further in view of Johnson. These rejections are respectfully traversed in view of the following remarks.

Claim 1 stands rejected as being unpatentable over Kayahara (a prior patent of the present inventor) in view of Lang. Kayahara teaches the benefits of reducing NOx emissions through an arrangement of water tubes and the use of exhaust gas recirculation. Lang teaches that steam may be added to a system to reduce NOx emissions. It is respectfully submitted that, for the reasons provided below, one skilled in the art would not be motivated to combine Lang and Kayahara, and that therefore, the present invention patentably distinguishes over these references.

Multiple methods exist for reducing NOx generation. Several of these methods are discussed in the present application and in the references of record. Many of these methods are based on the fact that NOx levels increase at high combustion temperatures;

therefore, various methods attempt to control combustion temperature to reduce NOx generation.

However, temperature cannot be reduced beyond a certain point without interfering with burner operation. Therefore, for example, increasing exhaust gas recirculation beyond a certain level ceases to be beneficial. Problems with recirculating too much exhaust gas are described, for example, at page 3, lines 1-13 of the specification. It is therefore submitted that those skilled in the art recognize that NOx reduction by limiting temperature can only achieve certain levels of NOx reduction; merely limiting temperature to a greater degree will not lead to further reductions in NOx levels.

From the above discussion, it should be clear that Kayahara cannot be improved merely by increasing the exhaust gas recirculation rate. One skilled in the art would understand Lang to teach an alternate way of reducing combustion gas temperature. However, because reducing combustion gas temperature by further increasing exhaust gas recirculation was known to be ineffective, there is no motivation to reduce combustion gas temperature by adding steam to the combustion air. In other words, one skilled in the art would consider further reducing temperature by the addition of steam to be as ineffective as further reducing temperature by the addition of more exhaust gas. These methods have been used independently, and different conditions make different NOx

reduction methods more or less desirable, but there is no suggestion in the prior art that the combination of three NOx reduction steps would provide a greater degree of NOx reduction than would be available using any one of the NOx reduction steps alone. For this reason, it is respectfully submitted that one skilled in the art would not be motivated to add water or steam to combustion-use air of a burner as required by claim 1 absent the teaching of the present disclosure. Claim 1 is submitted to patentably distinguish over the prior art for at least this reason.

Claims 2, and 5-10 depend from claim 1 and are therefore submitted to be allowable for the same reasons as claim 1. Claim 2 further requires a fourth step, namely, suppressing combustion gas temperature by burning the burner as a fully-premixing type burner at a high excess air ratio. Operating premix type burners in this manner was known to produce low NOx emissions. However, for the same reasons provided above in connection with claim 1, one skilled in the art would not understand that <u>further</u> NOx reductions could be obtained by combining this method of NOx reduction with previously known methods of NOx reduction. In other words, the reduction methods would be understood by those skilled in the art to be alternatives; there was no reason to believe that the reduction effects would be, in some cases, cumulative as discovered by the present applicant. Claim 2 is submitted to distinguish over the prior art for this reason.

Claim 5 further requires the additional step of providing a blower supplying combustion air to the burner and wherein the step of suppressing combustion gas temperature by adding water or steam to combustion-use air of the burner comprises the step of adding water or steam upstream of the blower. Lang adds steam to a flow path that is not upstream of the blower, and thus does not provide the degree of mixing of the water or steam and the combustion air provided by the invention required by claim 5. Claim 5 further defines over the prior art for this reason.

Claim 6 further requires the step of maintaining a high excess air ratio at a substantially constant level independent of an outside air temperature. As explained at page 37, lines 10-19 of the specification, without the constant excess-air-ratio control, there would arise a need for designing the processing capacity of the CO oxidation catalyst member 27 with a margin. Meanwhile, with the processing capacity increased, the pressure loss would increase. As a result, the pressure loss of the steam boiler itself would increase, giving rise to a need for redesigning the blower 4 or the boiler body 3. Performing the constant excess-air-ratio control has an effect of addressing these problems. This step is not shown or suggested by the prior art, and claim 6 is therefore submitted to further distinguish over the prior art.

Claims 9 and 10 further require that NOx emissions be maintained at a level of 10 ppm or less, at 0% O_2 in an exhaust

gas, dry basis. The prior art does not suggest that this degree of NOx reduction is possible. Claims 9 and 10 further define over the prior art for this reason.

Claims 3 and 4 are apparatus claims that require systems having multiple NOx reduction means for performing the NOx reduction steps of claim 1. Claims 3 and 4 are therefore submitted to be allowable for at least the same reasons as claims 1 and 2.

New claim 11 requires a combustion apparatus for NO_x reduction by controlling temperature of combustion gas derived from a burner having a burning reaction zone and an exhaust gas passage, that includes heat absorbers provided in the burning reaction zone for suppressing combustion gas temperature, an exhaust gas recirculation passage connected to the exhaust gas passage for recirculating burning-completed gas an air supply passage, and a line feeding water or steam to the exhaust gas recirculation passage upstream of the burner. This combination of features is not shown or suggested by the prior art, and claim 11 is therefore submitted to be allowable over the prior art of record. Claim 12 depends from claim 11 and is therefore submitted to be allowable for the same reasons as claim 11.

New claim 13 requires a combustion method for NO_x reduction by controlling temperature of combustion gas derived from a burner, that includes steps of suppressing combustion gas temperature by heat absorbers, recirculating burning-completed gas to a

combustion-gas burning reaction zone, adding water or steam to combustion-use air of the burner, and burning the burner as a fully-premixing type burner at high excess air ratio, so that NOx emissions are maintained at a level of 10 ppm or less, at 0% O_2 in an exhaust gas, dry basis. A method of reducing NOx emissions to this level using these steps is neither shown nor suggested by the prior art, and claim 13 is therefore submitted to be allowable.

New claim 14 requires a combustion method that includes the steps of burning fuel to produce gasses and exhaust gasses and maintaining a NOx level in the exhaust gasses at no more that 10 ppm or less, at 0% O_2, dry basis. The NOx level is maintained at this level by suppressing combustion gas temperature by heat absorbers, recirculating burning-completed gas to a combustion-gas burning reaction zone, and adding water or steam to combustion-use air of the burner. A method of maintaining NOx emissions at such a level using these steps is not shown or suggested by the prior art, and therefore claim 14 and its dependent claims 15 and 16 are submitted to be allowable.

Drawings

Descriptive legends have been added to elements of Figures 6 and 11.

Conclusion

Each issue raised in the Office Action dated June 2, 2004, has been addressed, and it is submitted that claims 1-16 are now in condition for allowance. Wherefore, reconsideration and allowance of claims 1-4 and examination and allowance of claims 5-16 is earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Scott Wakeman (Reg. No. 37,750) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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